Int. J. Environ. Res., 1(2): 88-95, Spring 2007
ISSN: 1735-6865

Identification of Fish-Eating Birds

Behrouzirad, B.*

Department of the Environmental Science, Science and Research Campus, IAU, Ahwaz, Iran

Received 20 July 2006; Revised 26 Nov 2006; Accepted 15 Dec 2006

ABSTRACT: There are 61 species in 14 families of fish-eating birds in Iran. The fish-eating birds of the north of Iran belong to 41 species in 10 families which include 67.2 percent of total fish eating bird species and 71% of fish-eating bird's family of Iran. Resident birds constitute 13% of the fish-eating birds of the Caspian Sea coasts and the rest are migratory in autumn and winter. There exist 3 globally threatened species of fish-eating birds of the world at the north of Iran, which are *Oxyura leucocephala, Phalacrocorax pygmeus*, and *Pelecanus crispus* wintering in the south coast wetlands of the region. Seventeen percent of the fish-eating birds of the north of Iran are aquatic, 5% terrestrial and 78 % wadding. The *Phalacrocorax carbo* and *Phalacrocorax pygmeus* are wintering and breeding migratory in the wetlands of the region, which feed in the fish ponds and wetlands. The main habitats of fish-eating birds are Miankaleh and Amirkelayeh wildlife refuge, Anzaly marsh and Gomishan Ramsar Sites. *Oxyura lecucephala*, *Phalacrocorax pygmeus* and *Pelecanus crispus* are protected species in Iran and the rest are not allowed to be eaten by Islamic rule, for the same reason they are not being threatened by Muslim men.

Key words: Fish-eating bird, Caspian Sea, Wetlands, Wintering, Breeding

*Corresponding author: Email-behrouzirad@yahoo.com

INTRODUCTION

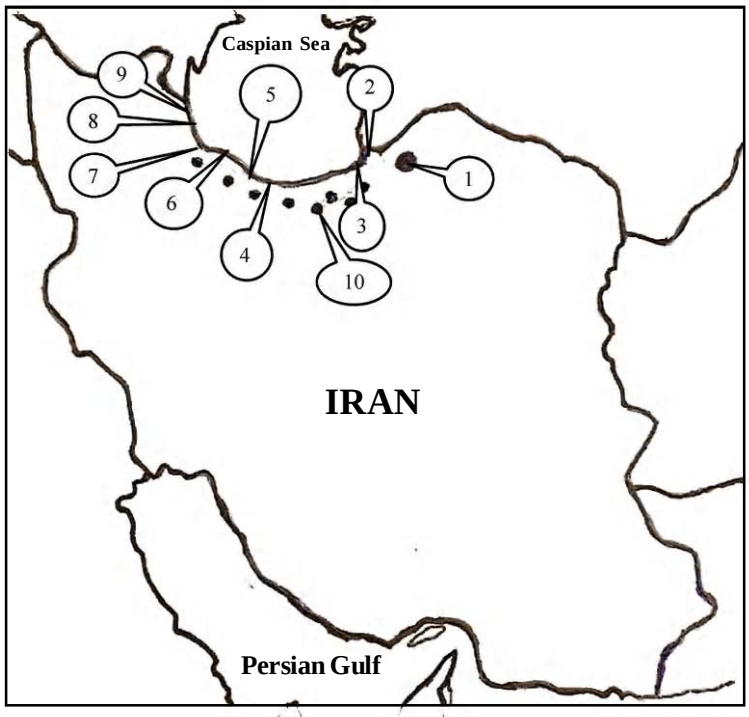
The study area is wetlands and coasts of Caspian Sea in north of Iran (Gilan, Mazandaran and Golestan provinces). The wetlands of Gilan, Mazandaran and Golestan comprise almost unbroken chain of freshwater lakes and marshes, brackish lagoons, irrigation ponds and rice paddies. Two of the most important wetlands in these lowlands are Anzaly marsh and the Gorgan Bay / Miankaleh complex (Evan, 1994, Scott, 1970 and 1995, Behrouzirad, 1997). One of the most important types of the wetland in the south Caspian lowlands are the Ab-Bandans, a small man made reservoirs. These shallow wetlands provide excellent feeding and roosting habitat for large number of fish-eating birds (Scott, 1995). Fish-eating birds have important role in Nature (Doorbon, 1984).The structure and behavior of every organism has involved in relation on its environment. Each has adapted to exploit a particular niche in which it is able to compete successfully with other organisms. Fish-eating birds as a group are suited to feed and breed in environments in which water forms a fundamental part. Within this general scheme, however, a wide range of forms has been developed to take advantage of particular environmental niches, so that at critical times competition between closely related groups is avoided. Fish-eating birds are biological indicator in aquatic environment, because these birds belong to the top level of food chain in aquatic ecosystems and the heavy metals calculate in various tissues of these birds. Hg was 2.89 ppm in feather of fish-eating birds in Khozestan and Persian Gulf coasts in south of Iran (Esmaili, , 2006). Ecological changed in northern wetlands of Iran caused changing number of breeding and wintering of fish-eating bird's population. Ecological values of fish eating birds in aquatic ecosystems in natural environment emphasizes to identification and investigation of these birds.

MATERIALS & METHODS

Identification of fish-eating birds of the south coast of the Caspian Sea lowlands and wetlands (Table 1 and Map 1), has been carried out in Oct, 2004-Oct, 2005, using binocular and telescope and some species of the birds have also been shot.

Table 1. Habitats surveyed in north of Iran

Habitats Name	Province
Anzaly marsh, Siahkeshim, Selkeh, Amirkelaye, Caspian coast, Alalan woodlands, Lavandavil swamps, Some Ab-Bandans, Lagoon Kiashar, Mouth of Sefidrud, Bojagh	Gilan
Ajygol, Alagol, Olmagol, Voshmgir Dam, Ab-Bandans, Gomishan marsh, Bibishivan, Inche Borone, Miankaleh, Gorgan Bay, Feridonkenar Damgah, Caspian coast, Ab-Bandans, Ramsar airport wetlands, Khoshkedaran woodland	Golestan Mazandaran



Map 1. Habitats of fish-eating birds in northern part of Iran

1-Alagol, Agygol, Ulmagol (wintering), 2-Gomishan (wintering), 3-Miankaleh (wintering and breeding), 4-Khoshkedaran (breeding), 5-Ramsar airport (breeding), 6-Amirkelaye (wintering and breeding), 7-Anzaly marsh (witering and breeding), 8-Alalan woodland (breeding), 9- Abas abad reservoir(breeding 1970s and wintering now), 10- Ab-bandans.

RESULTS & DISCUSSIONS

Forty one species of fish eating birds belonging to 10 families have been identified along the south coasts of Caspian Sea and northern wetlands (Fig 1 and Table 2). These coastal areas are of great value as a wintering station for over a million birds, including fish-eating birds and waterfowl. Fish-eating birds live in marshes, wetlands, rivers mouth and sea coasts. There are the following three groups of fish- eating birds at Caspian coasts and wetlands.

Migration-based grouping

Migratory breeders

Three species of fish-eating birds (*Chlidoniass hybridus, Sterna albifrons and Sterna hirundo)* migrate to the region in spring to breed in wetlands, marshes, and Ab-Bandans (Man made wetlands). The globally threatened species *Phalacrocorax pygmeus* (IUCN, 2004) was the migratory breeder and wintering in Anzaly marsh in Siahkeshim protected area. The breeding population of this species was considerable during 1970s in Anzaly marsh (Scott, 1995). During 1980s and 1990s it is not bred in the region. The breeder population of this species has returned to the Anzaly marsh since 2004 and about 80-100 pairs of this species bred in this marsh in 2004-2005 (Behrouzirad 2005). Breeder population of the *Chlidonians hybrid*us is more than the other two species. About 25000 pair of these species breed

Table 2. Fish eating birds of northern wetlands of Iran

Scientific name	Family	National law	IUCN* criteria	Migration	Population	Habitat
Tachybaptus	Podicipedidae	Non protected	-	Resident	Common	Water
Podiceps nigricollis	Podicepcidae	Non protected	-	Resident	Common	Water
Podiceps auritus	Podicepcidae	Non protected	-	Wintering	Common	Water
Podiceps grisegena	Podicepcidae	Non protected	-	Resident	Common	Water
Podiceps cristatus	Podicepcidae	Non protected	-	Resident	Common	Water
Botarus stellaris	Ardeidae	Non protected	-	Resident	Rare	Water
Ixobrychus minutus	Ardeidae	Non protected	-	Resident	Common	Coast
Nycticorax	Ardeidae	Non protected	-	Resident	Common	Coast
Ardeola ralloides	Ardeidae	Non protected	-	Resident	Common	Coast
Egretta alba	Ardeidae	Non protected	-	Resident	Common	Coast
Egretta garzetta	Ardeidae	Non protected	-	Resident	Common	Coast
Ardea cinerea	Ardeidae	Non protected	-	Resident	Common	Coast
Pelecanus	Pelecanidae	Non protected	-	Wintering	Common	Water
Pelecanus crispus	Pelecanidae	Protected	Vulenerable	Wintering	Rare	Water
Larus argentatus	Laridae	Non protected	-	Wintering	Common	Water
Larus genei	Laridae	Non protected	-	Wintering	Common	Water
Larus ridibundus	Laridae	Non protected	-	Wintering	Common	Water
Larus minutus	Laridae	Non protected	-	Wintering	Common	Water
Larus marinus	Laridae	Non protected	-	wintering	Common	Water
Larus canus	Laridae	Non protected	-	Wintering	Common	Water
Larus fuscus	Laridae	Non protected	-	Wintering	Common	Water
Chlidonias hybridus	Laridae	Non protected	-	Breeding	Common	Water
Chelidonias	Laridae	Non protected	-	Wintering	Common	Water
Sterna hirundo	Laridae	Non protected	-	Breeding	Common	Water
Sterna albifrons	Laridae	Non protected	-	Breeding	Common	Water
Gelochelidon	Laridae	Non protected	-	Wintering	Common	Water
Hydroprogne	Laridae	Non protected	-	Wintering	Common	Water
Chelidonias nigra	Laridae	Non protected	-	Wintering	Common	Water
Sterna sandivensis	Laridae	Non protected	-	Wintering	Common	Water
Phalacrocorax carbo	Phalacrocoracid	Non protected	-	Wintering	Common	Water
Phalacrocorax pygmeus	Phalacrocoracidae	Protected	Vulenerable	Wintering	Rare	Water
Alcedo atthis	Alcedenidae	Non protected	-	Resident	Common	Terrestrial
Pandion haliaetus	Pandionidae	Protected	-	wintering	Rare in Iran	Terrestrial
Oxyura leucocephala	Anatidae	Protected	Vulenerable	Wintering	Rare	Water
Mergus merganser	Anatidae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water
Mergus serattor	Anatidae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water
Mergus albelus	Anatidae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water
Stercorarius pomarinus	Stercoraridae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water
Stercorarius parasiticus	Stercoraridae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water
Gavia arctic	Gavidae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water
Gavia stelata	Gavidae	Non protected	Rare in Iran	Wintering	Rare in Iran	Water

*IUCN: International Union Conservation nature and natural resource

Table 3. Population of breeding species of fish-eating birds in north of Iran

Species	Breeding No.	Breeding Habitat	Reference
Sterna albifrons	300-400 pairs	Miankaleh and Ab-Bandans	Scott 1970s
Sterna albifrons	80-100 pairs	Miankaleh	Behrouzirad 1980s
Sterna albifrons	10 pairs	Miankaleh	Behrouzirad 2004-2006
Phalacrocorax pygmeus	Few pairs	Anzaly marsh	Scoot 1970
Phalacrocorax pygmeus	20pairs	Anzaly marsh	Behrouzirad 2004-2006
Chlidonias hybridus	2000-4000 pairs	Anzaly marsh	Scott 1970s
Chlidonias hybridus	5000 pairs	Anzaly marsh	Behrouzirad 1980
Chlidonias hybridus	1500 pairs	Anzaly marsh	Behrouzirad 2004-2006
Chlidonias hybridus	1500 pairs	Marzan Abad and Zarincola Ab-Bandans in Mazandaran	Behrouzirad 2004-2006
Sterna hirundo	Several pairs	Anzaly marsh	Scott 1970
Sterna hirundo	10-20 pairs	Miankaleh	Scott 1995
Sterna hirundo	8 pairs	Anzaly marsh	Behrouzirad 1983
Sterna hirundo	11 pairs	miankaleh	Behrouzirad 2005

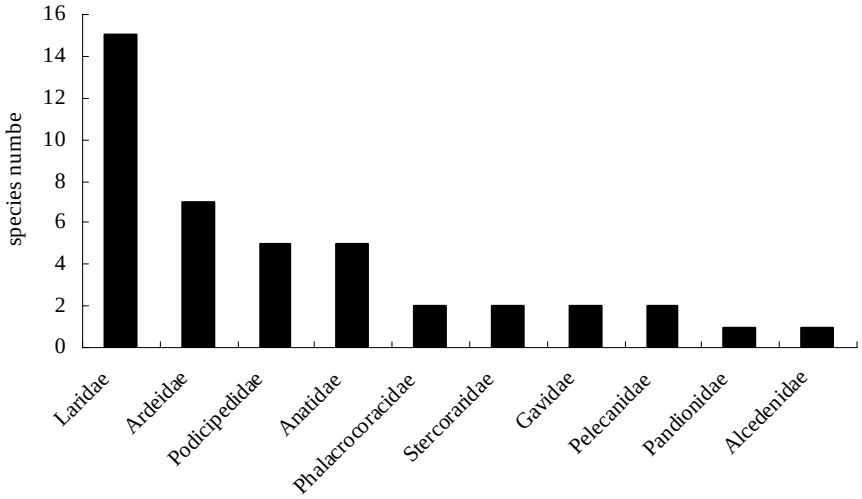


Fig. 1. Number of species of fish-eating birds in north of Iran

in Europe (Stanly1983, Allan 1998). Also about 1500 breed in Marzan Abad and Zarincola Ab-bandans in Mazandaran province and more than 1500 pair in Anzaly marsh in Gilan (Table 3).

More than 500 checks of this species have been ringed in Anzaly marsh during 1980s (Behrouzirad, 1983). *Sterna albifrons* was one of the breeder migratory species at around of Miankeleh wildlife refuge during 1970s (Scott, 1970s). The breeder population of this species was 500 pair, but a small population has been bred at Miankaleh during 1980s (Behrouzirad, 1985). Because of rising of Caspian Sea level during two last dedicate, the breeding habitats of the *Sterna albirons* disturbed and during 2004 and 2005 a few pairs of this species bred around the Miankeleh. The breeding population of *Sterna albifrons* was les than 10 pair in 2006 summer in the Miankaleh. (Table 3).

Residents

Eleven species of fish-eating birds are resident of the south coast of the Caspian Sea and northern wetlands. *Thachybaptus ruficollis, Ardea cinerea, Egretta garzetta and Alcedo atthis* are represent this group (Fig. 2).

Wintering

These birds migrate to the region in autumn and winter (Fig. 2). The Saw-bill Ducks and a lot of Gull species and Terns represent this group. *Oxyura lecocephala* is the wintering species of north wetlands of Iran. It is a globally threatened species. Miankaleh and Amirkelaye wildlife refuges and Lapo Zaghmarz and Seyed Mohaleh Ab-Bandans are wintering habitats of this species. The globally threatened species *Phalacrocorax pygmeus* is a wintering species of northern wetland of Iran. The main wintering habitat for *Pelecanus crispus* are Gomishan and Miankaleh (Table 4).

Table 4. Wintering population of globally threatened fish-eating birds in northern wetlands

Species	Wintering population	Habitats	Reference
Phalacrocorax pygmeus	650	Anzaly marsh	Scott 1970s
Phalacrocorax pygmeus	254	Lavandavil marshes	Behrouzirad 2006
Phalacrocorax pygmeus	100	Amirkelayeh	Scott 1970s
Phalacrocorax pygmeus	28	Miankaleh	Scott 1970s
Phalacrocorax pygmeus	453	Lavandavil marshes	Behrouzirad 1994
Phalacrocorax pygmeus	300	Kiashar lagoon	Scott 1970s
Phalacrocorax pygmeus	629	Lavandavil	Behrouzirad 2004
Phalacrocorax pygmeus	100	Seyed Mohaleh Ab-Bandan	Scott 1970s
Phalacrocorax pygmeus	1150	Anzaly marsh	Behrouzirad 1995
Phalacrocorax pygmeus	35	Amirkelaye	Behrouzirad 1995
Pelecanus crispus	690	Miankaleh	Scott 1970s
Pelecanus crispus	800	Miankaleh	Behrouzirad1994
Pelecanus crispus	1	Amirkelaye	Behrouzirad1994
Pelecanus crispus	234	Gomishan	Behrouzirad1994
Pelecanus crispus	835	Gomishan	Behrouzirad 2004
Pelecanus crispus	6	Anzaly marsh	Scott 1970s
Pelecanus crispus	41	Kiashar lagoon	Scott 1970s
Pelecanus crispus	334	Gomishan	Scott 1970s
Pelecanus crispus	112	Gomishan	Behrouzirad 2005
Oxyurea leucocephala	25 passage	Anzaly marsh	Scott 1970s
Oxyurea leucocephala	27	Seyed Mohaleh Ab-Bandan	Scott 1970s
Oxyurea leucocephala	453	Miankaleh	Scott 1970s
Oxyurea leucocephala	19	Alagol	Scott 1970s
Oxyurea leucocephala	1450	Alagol	Scott 1970s
Oxyurea leucocephala	3	Miankaleh	Behrouzirad 2005

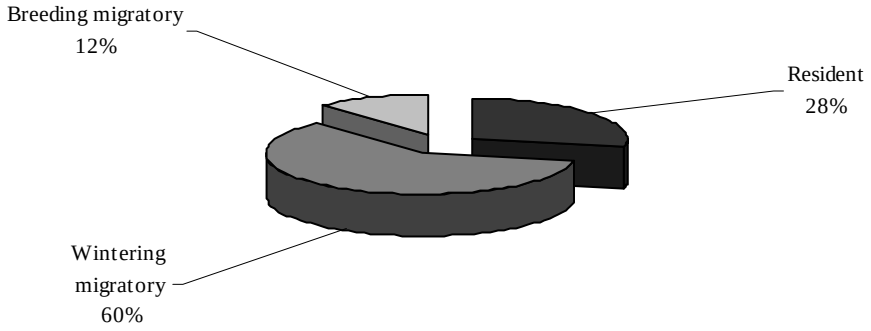


Fig. 2. Relative temporal abundance of fish-eating birds

Habitat preference based grouping

Habitat preference-based of fish-eating birds of the south coast of the Caspian Sea and wetlands are divided into the three following groups, (Fig3):

Terrestrial species

These species live on land and are not swimmers; they only depend on water bodies for feeding. Tow species (*Alcedo atthis* and *Pandion haliaetuse*) represent this group.

Wadding birds

These species live along the edges of water bodies, but do not swim. Species of *Ardeidae* represent this group.

Aquatic birds

These swimming species feed in various water bodies (saline, Fresh and Brackish water) (Doorbon, 1984).

Phalacrocoracidae, Pelecanidae, Podicepcidae and *Laridae* species represent this group.

Population based grouping

Based on population fish-eating birds of the Caspian coasts can be divided into the following tow groups, (Fig. 4).

Threatened species

These species are globally threatened and their population is very low in the region. They have been listed on Red Data Book of IUCN, 2004. Dalmation pelican *Pelecanus crispus*, Pygmy Cormorant *Phalacrocorax pygmeus* and White-headed Duck *Oxyura leucocephala* belong to this group. Breeding population of *Phalacrocorax pygmeus* was 80-100 pair in Anzaly marsh, wintering population of *Pelecanus crispus* was about 500 individual (mainly in Gomishan and Miankeleh) and wintering population of *Oxyura leucocepha* was 3 individuals in Miankaleh (Table 4). Eight species are not globally threatened, but are rare in north of Iran (Table 2).

Common species

Population of these species is common in the region. Herons *Ardeidea and Laridae* species represent this group.

Classification based on feeding behavior

Based on feeding behavior fish- eating bird is divided into the following four groups (Fig. 5).

- Group moving, moving feeders, these birds move in group and feed while moving (Barber 1989). Cormmorant *Phalacrocorax Carbo* represents this group.
- Individual, moving and still-feeder, these birds move individually and feed while still. Great White Egret *Egretta Alba* and Grey Heron *Ardea cinerea* represent this group.
- Combined moving and feeding behavior, these species show a combined feeding and moving behavior as the earlier two categories. Ardeidae species represent this group.
- Individual moving and moving feeder, these birds move individually and feed while moving, White Headed Duck .*Oxyura leucocephala* represent this group.

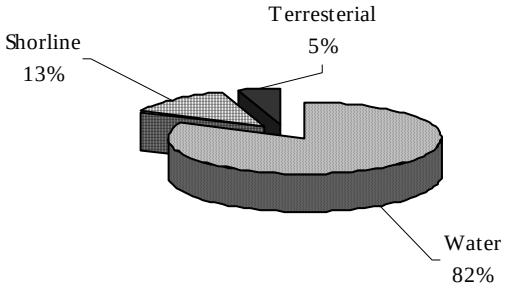


Fig. 3. Relative abundance of fish-eating birds on habitat preference

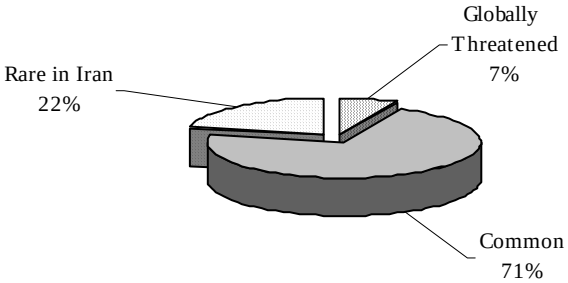


Fig. 4. Abundance percentage of fish-eating birds population

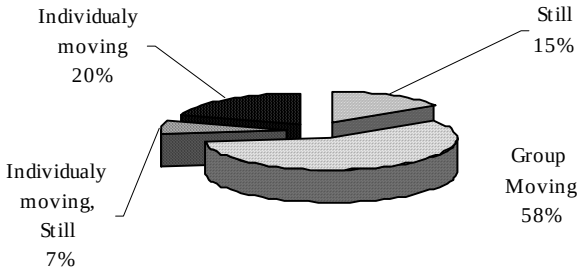


Fig. 5. Abundace percentage of Fish-eating birds feeding behavior

Miankaleh peninsula, and Gorgan Bay wildlife refuge (most of the peninsula is covered with a carpet of herbaceous plants and grasses. The western half also supports scrubby woodland. The extensive seasonally flooded marshes at the west end of the bay are dominated by sedges), Agygol, Olmagol, Alagol, (isolated lakes in a region of gently undulating grassy plain on the Turkman Steppes east of the Caspian Sea.), Ab-Bandans (man made wetlands) and Gomishan marsh (The recent 1.8 m rise in the level of the Caspian Sea has resulted in extensive flooded of these plains, with the result that the Gomishan marshes now comprise a large area of shallow, brackish lagoons and marshes covering at least 15000 ha.), in Mazandaran province, Anzaly marsh, Siahkeshim protected area, Selkeh wildlife refuge (Siahkeshim and Selkeh are part of the Anzaly marsh.

The Anzaly marsh comprises a complex of large, shallow, eutrophic, freshwater lagoons, marshes and seasonally flooded grasslands, separated from the Caspian Sea by a sandy barrier, about one km wide, with open grassland, pomegranate scrub and sand dune vegetation and Amirkelaieh wildlife refuge (Amirkelayeh marsh is a permanent, eutrophic, freshwater with rich growth of floating and submerge vegetation, extensive fringing reed-beds of Typha and Phragmites and some Willow thickets) Ramsar sites, Abas-abad marsh (Abbas-abad marsh is a small water storage reservoir used for irrigation purposes in an area of deciduous woodland on the narrow coastal plain of the Caspian Sea, about 5 km south of Astara), in Gilan province are regarded as sensitive and important area for fish-eating birds (Table 5).

Table 5. Sensitive habitats for wintering and breeding fish-eating birds in northern Iran

Name	Breeding	Wintering sites
Phalacrocorax Carbo	Alalan, near Hashtpar , Abas abad, closed to Astara, Khoshkedaran before 1980s , Ramsar airport at recent years	Miankaleh, Gomishan , Anzaly marsh, Amirkelayeh,
Phalacrocorax pygmeus	Anzaly marsh before 1970s. in Siahkeshim (recent years)	Anzaly marsh, Miankaleh, Lavandavil, Amirkeleyeh
Anatidae	-	Miankaleh , Anzaly marsh
Larus sp	-	Anzaly marsh, Miankaleh Protected Area, Caspian Coasts, Ab-Bandans,
Pelecanus crispus	-	Gomishan, Miankeleh
Ardeidae	Anzaly marsh, Khoshkeh daran before 1990s, Alalan marsh, Ramsar airport marshes recent years	Anzaly marsh, Miankaleh, Amirkeleyeh,
Podicipididae	Anzaly marsh, Amirkelaye	Anzaly marsh, Amirkelaye, Miankaleh
Sterna ssp	Miankaleh, some Ab-Bandans, Anzaly marsh	Anzaly marsh, Miankaleh, Amirkelayeh, Ab-bandans
Chlidonias hybrida	Anzaly marsh, Ab-bandans of Mazandaran (breeding).	Anzaly marsh, Miankaleh, Amirkelayeh, Ab-bandans

CONCLUSION

Fourteen fish-eating birds family exist in Iran that constitute about 7.4 percent of bird families in the country (Behrouzirad, 1997) .Ten families constituting 41 identified fish-eating bird species exist along the southern coast of the Caspian sea ,which constitute 67.2 percent of total fish-eating and 8 percent of total bird species observed in Iran. Tow species *Alcedo atthis*, a resident and *Pandion haliaetus* a winter migratory are terrestrial birds, but feed on fish in wetlands. Eight species of Herons live along the margin of water bodies, of which *Ardea cinerea*, *Egretta Alba*, *Egretta garzetta* and *Nycticorax nycticorax* can be observed throughout the year and breed with Cormorants in Alalan woodland marsh, Anzaly marsh and around the woodland marshes of the Ramsar airport. Breeding population of all above mentioned species have been greatly disturbed in Abas-abad marsh due to heavy deforestation. Their breeding is currently restricted to Alalan and Ramsar airport marshes with very limited breeding in Anzaly marsh.

The *Podicipedidae* species are common wintering birds in Anzaly marsh, Amirkelaieh and Miankaleh, but the *Tachybaptus ruficollis* breed in Ab-bandans, Anzaly marsh and Miankaleh.

About 15000 pairs of *Phalacrocorax carbo* with *Ardeidae* species were reported to breed in Abas-abad and nearby marshes during 1970s (Evan, 1994, Scott, 1970 and 1995, Behrouzirad, 1979 and 1997), but the number is limited to 5000 pairs in Ramsar airport and Alalan in 2004-2006 (Behrouzirad 2006). After tens of years the Pygmy Cormorant *Phalacrocorax pygmeu*s regard as a globally threatened species (IUCN, 2004) used to breed in Anzaly marsh during 1970s (Scott, 1970s) retuned to the Anzaly marsh and in 2006, 80-100 pair have been bred on the Salix tree in the Siahkeshim protected area (Behrouzirad, 2006) . All Gull species *Larus sp.*are wintering birds throughout the Caspian region of Iran. Tow Tern species *Sterna albifrons* and *Chlidonias hybridus* breed in the various wetlands of the region. Diversity of *Laridae* with 15 species is more than the others and *Alcedenidae* and *Pandionidae* are less than other families (Fig. 1). Bitren *Butarus stelaris* is rare species that breed in reed-beds of the region (Scott 1970s), but no longer found to breed in the area, although limited wintering is reported (Behrouzirad, 1997). Two species of Skua, *Stercoraridae*, *Stercorarius pomarinus* and *Stercorarius parasiticus* and two species of Divers, Gavidae *Gavia arctic* and *Gavia stelata* are only observed in the Caspian Sea and not in the wetlands. No information on population status of these species is currently available. Abundance and diversity of fish-eating birds in various habitat of the Caspian region depend on the security and food abundance. From breeding point of view Anzaly marsh, Ramsar airport, and Alalan are regarded as sensitive areas and from wintering point of view; Miankaleh, Anzaly marsh, Gomishan and Amirkelaieh are regarded as sensitive areas (Table 5).

REFERENCES

Allan, D. G., (1998). Whisked Tern Breeding in the Southeastern Transvaal Highvald, South Africa, Cormorant, **16**, (1), 23-29.

Behrouzirad, B., (1984). Feeding behavior of cormorant in fish pond in Khozestan Province unpublished report, 15.

Behrouzirad, B., (1977-1991). Pelicans ringing report in Uromieh Lake unpublished reports.

Behrouzirad, B., (1977-1979), Cormorants ringing report in Gilan and Mazandaran Province, unpublished reports.

Behrouzirad, B. (1977-1984), Terns ringing reports in Gilan Province, unpublished reports.

Behrouzirad, B., (1987), Dalmation Pelecan as a Threatened species, J. Environ., D.O.E. Spring 1997. **2** (3), 17-29.

Behrouzirad, B., (1997): Animal migration, (in Farsi), Seasonal Journal of Environment, D.O.E.Winter 1997.

Behrouzirad, B, 1983, Birds ringed and recoverd in Iran, Uring Data Bank, 1983.

Behrouzirad, B., 1995- 2005, Mid-winter Water birds count, (in Farsi) unpublished reports, D.O.E.

Barber ,S,G.M.&T.J.Wassenorey (1989). Feeding ecology of the picivorus birds, Marin Biology, Astralia.

Carss, D. N. and Marqivs, M., (1991). Avian peredation at farmland and natural fisheries, Institute of terrestrial ecology, Scotland.

Doorbon, J. (1984): Picivorus birds on the saline lake, Journal of the sea research Group, the Netherlands.

Esmaili, A., & et al, (2006), Hg consentration in feather of Fish-eating birds in Kozestan province and Persian Gulf coasts. Abstracts of The 3th Iranian Congress on Environment Crises and their Rehabilitation Methodologies, Ahwaz, 27-29-Dec.

Evan, D.,(1994). Important birds area in the Middle East. IUCN.

IUCN, (2004), Red Data Book of IUCN, Gland, Switzerland.

Scott, D., (1995). A Directory of wetlands in the Middle East, IUCN.

Scott, D, (1970-1979). Birds survey reports, unpublished reports, D.O.E.

Stanly, C., (1983). the birds of the Western Palearctic, Vol 1, Oxford.